# FLUORIDES, HYDROGEN FLUORIDE, and FLUORINE

## CAS # 7681-49-4, 7664-39-3, 7782-41-4

**Agency for Toxic Substances and Disease Registry ToxFAQs** **April 1993**

**This fact sheet answers the most frequently asked health questions (FAQs) about fluorides, hydrogen fluoride, and fluorine. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**SUMMARY: Exposure to fluorides, hydrogen fluoride, and fluorine happens mostly from eating contaminated foods, breathing workplace air, or eating toothpaste. Exposures are usually low and not harmful. High exposures can cause lung, skin, and bone damage. Fluorides, hydrogen fluoride, and fluorine have been found in at least 130, 19, and 28 sites, respectively, of 1,334 National Priorities List sites identified by the Environmental Protection Agency (EPA).**

### What are fluorides, hydrogen fluoride, and fluorine?

(Pronounced flôr′ īdz, hī′drə-jən flôr′ īd, and flôr′ ēn)

Fluorides, hydrogen fluoride, and fluorine are chemically related. Fluorine is a pale, yellow-green gas that has a strong, sharp odor. It combines with hydrogen to make hydrogen fluoride, a colorless gas. Hydrogen fluoride dissolves in water to form hydrofluoric acid. Fluorine also combines with metals to make fluorides like sodium fluoride and calcium fluoride, both white solids. Sodium fluoride dissolves easily in water, but calcium fluoride doesn't.

Fluorine is used in rocket fuels, glass, enamel, and bricks. Hydrogen fluoride is used mainly to make aluminum and chlorofluorocarbons (CFCs). Fluorides are used in making steel, chemicals, ceramics, lubricants, dyes, plastics, and pesticides (for ants and roaches). Toothpaste and mouth rinses have fluorides added to prevent cavities.

If drinking water supplies are low in fluoride, many communities add fluorides to help prevent cavities. Some skin medicines and cancer treatment drugs also contain fluorides.

### What happens to fluorides, hydrogen fluoride, and fluorine when they enter the environment?

- ❑ Fluorine forms salts with minerals in soil, and doesn't evaporate back into air as a gas.
- ❑ Fluorides if released to the air from volcanoes and industry are carried by wind and rain to nearby water, soil, and food sources.
- ❑ They erode from rocks into soil and water, and leach from phosphorus fertilizers into food and water supplies.
- ❑ Some plants take up and store fluorides in their leaves and stems.

### How might I be exposed to fluorides, hydrogen fluoride, and fluorine?

- ❑ Breathing workplace air where fluorides are used or released.
- ❑ Eating food from soil with high natural levels or high levels from fertilizers or nearby waste sites.
- ❑ Eating toothpaste that contains fluorides.
- ❑ Drinking contaminated water.
- ❑ Ingesting contaminated soil particles.

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**ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html**

## How can fluorides, hydrogen fluoride, and fluorine affect my health?

Fluorides are everywhere throughout the environment, but at very low levels that are not believed to be harmful. At high levels, fluorine gas and hydrogen fluoride gas can harm the lungs and heart and can cause death. Even at low levels, these gases can irritate your eyes, skin, and lungs. Contact with hydrofluoric acid can burn the eyes and skin. This mainly happens in the workplace.

Small amounts of sodium fluoride help reduce tooth cavities, but high levels can harm your health. In children whose teeth are forming, high fluoride exposure can cause dental fluorosis with visible changes in the teeth. In adults, high flouride exposure over a long time can lead to skeletal fluorosis with denser bones, joint pain, and a limited joint movement. This is extremely rare in the U.S.

We don't know the effects of fluoride on reproduction or developing fetuses. Cows and various birds are known to have reproductive problems when they eat or drink large amounts of fluoride. The results from laboratory studies in animal are mixed.

## How likely are fluorides, hydrogen fluoride, and fluorine to cause cancer?

Fluorine, hydrogen fluoride, and fluorides have not been classified for carcinogenic effects. Studies in people have not shown fluorides to be carcinogenic, and the studies in animals are mixed. More research is in progress.

## Is there a medical test to show whether I've been exposed to fluorides, hydrogen fluoride, and fluorine?

Tests are available to determine recent high exposures to fluorides. The test measures fluorides in the urine. This test cannot predict any specific health effects from fluoride exposure. Most laboratories that test for chemical exposure can perform the test. Bone sampling is done in special cases to measure a long-term exposure to fluorides. Because fluorine, hydrogen fluoride, and fluorides all enter the body as fluoride, these tests do not distinguish the source of the fluoride.

## Has the federal government made recommendations to protect human health?

The EPA sets a maximum amount of 4 milligrams fluoride per liter of drinking water (4 mg/L). EPA recommends that states limit fluoride in drinking water to 2 mg/L.

Spills of more than 10 pounds of fluorine, 100 pounds of hydrogen fluoride, or 1,000 pounds of sodium fluoride must be reported to the National Response Center.

The Occupational Safety and Health Administration (OSHA) limits an 8-hour work day, 40-hour work week to 0.2 milligrams of fluorides per cubic meter air (0.2 $mg/m^3$). The level for hydrogen fluoride is 2.5 $mg/m^3$. The highest level of fluoride allowed by OSHA for an 8-hour work day, 40-hour work week is 2.5 $mg/m^3$.

## Glossary

Carcinogenic: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Ingestion: Taking food or drink into your body.

Milligram (mg): One thousandth of a gram.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 1993. Toxicological profile for fluorides, hydrogen fluoride, and fluorine (F). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-639-6359. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.